

Evaluation of owner experiences and adherence to home-cooked diet recipes for dogs[†]

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OBJECTIVES: To evaluate owner experiences and adherence to home-cooked diet recipes for dogs.

METHODS: Clients of a veterinary teaching hospital clinical nutrition service who had a home-cooked diet recipe formulated for their dogs between March 2011 and December 2013 were given a survey by email, postal mail and telephone. Survey questions addressed motivations, positive and negative aspects of feeding home-cooked diets and current feeding practices. Responses were compared to animals' medical records to determine adherence.

RESULTS: Of the 93 owners who were contacted, 53 (57%) completed the survey. Of the 53 respondents, 43 owners (81%) reported that they were still feeding an home-cooked diet or had fed an home-cooked diet until the time of their dogs' deaths. The most common motivation for feeding a home-cooked diet was suitability for specific medical needs. Of the 30 surveys that included a complete diet history, only four (13%) demonstrated exact adherence to home-cooked diet recipes.

CLINICAL SIGNIFICANCE: Most respondents liked and continued to feed a home-cooked diet, but few owners adhered to prescribed recipes and many dogs required recipe modifications. It is important to counsel dog owners about benefits and drawbacks of feeding home-cooked diets, importance of recipe adherence and necessity for follow-up after diet formulation with a board-certified veterinary nutritionist.

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INTRODUCTION

Although studies have shown that over 90% of dogs and cats in the United States are primarily fed a commercial pet food, some pet owners prefer to feed their pets a home-cooked diet (HCD) (Laflamme *et al.* 2008, Freeman *et al.* 2013, Connolly *et al.* 2014). A small proportion of pet owners elect to feed an HCD to dogs with medical problems when nutritional needs cannot be met by a commercial diet. However, other owners elect to feed an HCD for non-medical reasons such as distrust of commercial pet foods, desire to control dietary ingredients or other personal beliefs (Laflamme *et al.* 2008, Connolly *et al.* 2014). Current evidence does not support any nutritional or health benefits of HCDs over complete and balanced, good-quality commercial

pet foods; however, anecdotally, the practice of feeding HCDs appears to be increasing among pet owners.

Pet owners who elect to feed an HCD may obtain a recipe from books, the internet, veterinarians, friends, breeders or board-certified veterinary nutritionists; some may not follow a specific recipe. Previous studies have evaluated the nutritional adequacy of commonly available HCD recipes for dogs and cats (Heinze *et al.* 2012, Larsen *et al.* 2012, Stockman *et al.* 2013). Of the 200 recipes evaluated in these studies, only 10 (5%) were nutritionally complete and balanced. Case reports have illustrated the negative consequences of feeding unbalanced HCDs (de Fornel-Thibaud *et al.* 2007, Taylor *et al.* 2009, Hutchinson *et al.* 2012) and the authors have treated clinical cases of nutrient deficiencies secondary to improperly formulated HCDs. Based on the high rates of nutritional inadequacy in commonly

available HCD recipes and resulting health risks, it is strongly recommended that pet owners work with a board-certified veterinary nutritionist for formulation of HCD recipes to minimise risk of nutrient deficiency or toxicity (American College of Veterinary Nutrition 2015, European College of Veterinary Comparative Nutrition 2015).

Even when a nutritionally balanced HCD recipe is used, other risks remain. Formulation of HCD recipes often relies on ingredient profiles reported in databases such as the United States Department of Agriculture, Agricultural Research Service (2014). If there is major variation between an owner's purchased ingredients and samples evaluated to establish the database's nutrient profiles, the prepared HCD may not match calculated nutrient concentrations. In addition, nutrient bioavailability may vary because of ingredient composition and inter-ingredient interaction. For example, phytate in plant material can impact calcium and phosphorus absorption, and may alter bioavailability of these minerals in an HCD. Due to cost and impracticality, HCDs are not commonly tested for nutrient content after preparation, or evaluated through standardised feeding trials, so there may be greater risk for inadvertent discrepancies between desired and delivered nutrient concentrations compared to commercial diets. Finally, owners may modify initially balanced HCD recipes, introducing nutritional imbalances. Owner adherence to prescribed HCD recipes has not been previously reported.

The goals of this study were to characterise owner experiences with feeding HCDs to dogs and to evaluate adherence to HCD recipes.

MATERIALS AND METHODS

Eligible participants included all dog owners for whom an HCD recipe was formulated by a veterinary teaching hospital's clinical nutrition service between March 2011 and December 2013. Owners of both healthy dogs and dogs with medical conditions were included.

Survey design

The authors created a survey regarding owner experiences with feeding an HCD and current feeding practices. Owners were asked whether they liked feeding an HCD, followed by open-ended questions asking what aspects of feeding an HCD they liked and disliked and what reasons they had for feeding an HCD. Owners were also asked whether any changes had been made to the original recipe; if yes, owners were asked to note whether they had a recipe reformulation, added ingredients, discontinued ingredients and/or changed ingredients; owners were offered the option to select "other" and describe further. Owners were also asked when changes were made. Owners of dogs that were still alive were asked to complete a tabular diet history form, listing all daily food ingredients and amounts per meal "providing enough detail for a pet sitter to prepare [their] dog's regular diet." Examples demonstrated desired level of specificity (e.g. "90% lean hamburger, pan-fried, 3 oz."). Owners who had discontinued feeding an HCD were asked how long they had fed

an HCD, asked to select one or more reasons for discontinuing (cost, time, pet preference, other) and provided space for comments. Owners whose dogs were no longer living were asked if they had fed an HCD until the time of their dogs' deaths.

Survey administration

The survey and a letter explaining the study were emailed to eligible owners with a known email address; owners were also sent the survey through postal mail unless they had already responded through email. Owners who did not respond were then contacted over telephone to complete the survey. Surveys were estimated to require 5 to 15 minutes to complete. No incentives were offered for participation. Respondent demographics were not collected; surveys were identified by the dogs' medical record numbers to compare their current feeding practices to most recently prescribed HCD recipes. The experimental protocol was reviewed by the university institutional review board.

Data analysis

For open-ended survey questions, patterns were identified and answers were grouped to assess response frequencies. Positive aspects of feeding ("likes") and reasons for feeding an HCD were grouped into five categories: perceived superiority of HCD quality/nutrition over commercial diets, increased control over their dogs' diet, mistrust of commercial dog foods, greater palatability, and suitability for specific medical needs. Negative aspects of feeding an HCD ("dislikes") were grouped into four categories: work (i.e. time, effort), poor palatability, expense and the sensory process of food preparation (e.g. disliking the smell of cooking chicken). Reasons for discontinuing feeding an HCD were grouped into two categories: dog-driven (e.g. appetite, changing medical needs) and owner-driven (e.g. time, expense).

Adherence was assessed for respondents currently feeding an HCD. Respondents' diet history forms were compared to the original HCD recipe or, if subsequent changes had been made by the clinical nutrition service (e.g. calorie adjustments or recipe reformulation), to most recent recommendations. Deviations from most recent recommendations were considered to be instances of non-adherence and were grouped into changes that were disclosed in the survey (i.e. respondents indicated that changes had been made to the original recipe) or changes that were not disclosed in the survey (i.e. respondents indicated that no changes had been made, but current feeding practices did not match recommendations). Numbers of adherent and non-adherent respondents were counted, and instances of non-adherence were grouped into four main categories: changed amounts, added ingredients, omitted ingredients and ingredient substitutions (e.g. chicken instead of beef). Original HCD recipes provided non-liquid ingredient amounts in grams/ounces and liquid or powdered ingredients in standardised measurements (e.g. tablespoons or millilitres); respondents who provided less specific ingredient quantities (e.g. "1 chicken thigh") that could introduce nutrient variation were counted as a change in ingredient amount. Non-adherence was further subdivided by the types of ingredients that the owners had modified: protein, carbohydrate, fat or vitamin/mineral supplement. Responses with insufficient

information to assess adherence (e.g. no ingredient amount specified) were counted separately.

Descriptive data were reported as counts and percentages of respondents and presented as median and range. All analyses were performed using commercial statistical software (Microsoft Excel for Mac 2011, Microsoft Corp, Redmond, WA).

RESULTS

Ninety-three dogs had HCD recipe formulation between March 2011 and December 2013. Owners of these dogs were contacted and 53 (57%) respondents completed the survey. Of the 53 respondents, 39 (74%) reported that their dogs were alive and 14 (26%) reported their dogs were no longer alive.

Respondent information

The median age of respondents' dogs at the time of HCD formulation was 8 years (range, 1 to 16 years), with 28 males (23 castrated) and 25 females (all spayed). The most commonly represented breeds were mixed breed (n=13), Labrador retriever (n=5) and bichon frise (n=4), but many other breeds were included. Five dogs were healthy and 48 had medical conditions (Table 1).

Of the 39 respondents who reported their dogs were alive, 33 (85%) were still feeding their dogs an HCD. The clinical nutrition service had recommended changes after the initial consultation for 19/33 respondents (58%): 12/33 respondents (36%) were recommended to make proportional calorie adjustments and 13/33 respondents (39%) received a recipe reformulation (some respondents received both types of recommended changes). Reasons for HCD recipe reformulation included owner desire to use different non-supplement ingredients (n=7), change in dogs' medical status (n=6), owner desire for variety (n=6), change in ingredient availability or formulation (n=4), and owner desire to use different supplements (n=4); some HCD recipes were reformulated for multiple reasons. Of the 14 respondents who reported their dogs were no longer alive, 10 (71%) had fed an HCD until the time of the dogs' death.

Of the 53 total respondents, 10 (19%) discontinued feeding an HCD, including dogs that were alive and dogs that had

died (in which case the respondents had discontinued feeding the HCD before the dog's death). Of the 10 respondents who had discontinued feeding an HCD, seven discontinued because of dog-driven reasons (pet preference/appetite [n=5] and/or changing medical needs [n=3]) and three discontinued because of owner-driven reasons (time [n=2], cost[n=1] and/or difficulty with recipe preparation [n=1]).

Respondent experiences

Owners of dogs that had died or were alive and still being fed an HCD (n=47) were asked about their likes, dislikes, and motivations for feeding an HCD (Table 2). Forty-four of these respondents (94%) reported that they liked feeding an HCD. The most commonly reported motivation for feeding an HCD was suitability for specific medical needs. The most commonly reported positive aspects of feeding an HCD were perceived superiority over commercial diets and suitability for medical needs. The most commonly reported negative aspect of feeding an HCD was the amount of work involved.

Respondent adherence

Of the 39 dogs that were alive at the time of the survey, 33 dogs (85%) were still being fed an HCD. Three surveys could not be used for evaluation of adherence because of incomplete responses in the diet history form. Only 4 of the remaining 30 respondents (13%) demonstrated exact adherence. Two additional respondents did not include sufficient information about ingredient preparation to confirm exact adherence (e.g. "cooked lamb" rather than "broiled lamb"), but listed correct ingredients and amounts.

Non-adherence results are summarised in Fig 1; 15 respondents made more than one change. Five respondents changed ingredient amounts by feeding non-specific amounts of ingredients (e.g. 2 chicken thighs rather than 250 g of chicken thigh). Four respondents made a calculation error when attempting to adjust ingredients proportionally to adjust total calorie intake (e.g. decreasing some ingredients by 20% but neglecting to proportionally decrease the amount of oil and vitamin/mineral supplement). At least three respondents changed ingredient preparation methods (e.g. feeding raw instead of baked chicken);

Table 1. Medical conditions of dogs owned by 53 survey respondents for which home-cooked diets were formulated

Medical condition	Number of dogs*
Renal disease	23 (43%)
Gastrointestinal disease	14 (26%)
Dermatologic disease	10 (19%)
Cardiac disease	10 (19%)
Pancreatitis	8 (15%)
Hepatic disease	6 (11%)
None (healthy)	5 (9%)
Urolithiasis	5 (9%)
Seizures	3 (6%)
Neoplasia	3 (6%)
Diabetes mellitus	2 (4%)

*Twenty-two dogs had multiple medical conditions

Table 2. Aspects of feeding an home-cooked diet that owners liked and disliked and owner motivations for feeding an home-cooked diet, from 47 respondents who answered these questions (out of 53 total respondents)

	Likes	Motivations
Perceived superiority over commercial diets	15 (32%)	9 (19%)
Appropriateness for medical needs	15 (32%)	34 (72%)
Desire for control over dogs' diet	11 (23%)	5 (11%)
Greater palatability	8 (17%)	8 (17%)
Mistrust of commercial dog foods	2 (4%)	6 (13%)
	Dislikes	
Work	30 (64%)	
Poor palatability	5 (11%)	
Expense	4 (9%)	
Sensory process of food preparation	2 (4%)	
Responses in more than one category were possible		

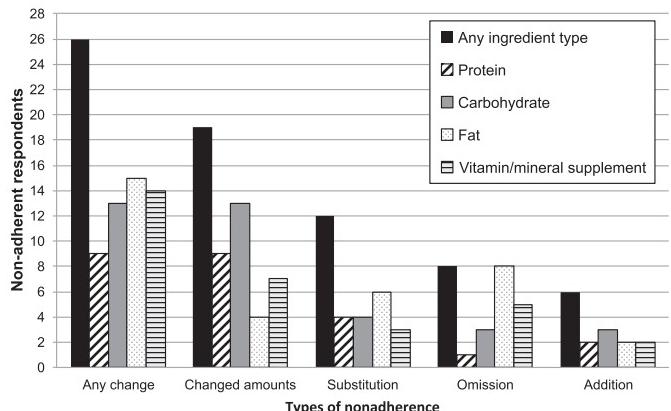


FIG 1. Dog owners who were non-adherent to home-cooked diet recipes, from a population of 30 survey respondents. Non-adherent owners are grouped ("any change") and subdivided according to type of non-adherence (e.g. changed amounts, substitution, etc.). Non-adherence is also grouped ("any ingredient type") and subdivided according to type of ingredient (e.g. protein, carbohydrate). Fifteen respondents made more than one change

13 respondents did not describe ingredient preparation methods meaning that this aspect of adherence could not be assessed. Only 10 respondents provided detail on when disclosed changes were made; estimated length of time between original consultation and first change ranged from 0 to 742 days (median = 59.5 days). Of 26 non-adherent respondents, 16 (62%) did not disclose that they had made changes to their dogs' diets; non-adherence was only apparent when comparing reported current feeding practices to medical records.

For the 30 cases in which adherence could be assessed, the median number of ingredients in the original HCD recipes was 7 (range 4 to 13). For these cases, the median length of time between HCD recipe formulation and survey completion was 352 days (range 39 to 1070 days).

DISCUSSION

Although many respondents liked and continued to feed an HCD, very few continued to feed their HCD recipes exactly as instructed. The rate of exact adherence was only 4/30 (13%); even if exact adherence was assumed for the two respondents who reported correct ingredients and amounts but gave insufficient detail about ingredient preparation, this would only increase the rate of adherence to 6/30 (20%). Almost all respondents had made changes from their original recipe that had not been prescribed by the clinical nutrition service. These respondents demonstrate "diet drift," where an owner begins with a nutritionally complete HCD recipe, but deviates from recipe instructions with time. Owners may not recognise that changes such as substituting different oils or omitting a vitamin/mineral supplement can affect the nutritional composition of the HCD recipe and lead to health risks due to nutrient imbalances. These issues are particularly concerning given that most dogs in this study had pre-existing health conditions that might put them at greater risk

for adverse consequences of an unbalanced diet. Since adult dogs may not manifest clinical signs until nutrient deficiencies are very severe, it is important to be proactive in emphasising the risks of recipe deviation to owners and in monitoring for adherence. The veterinary health care team should counsel owners on the necessity of accurate HCD preparation and re-evaluate feeding practices with these owners over time to identify and address areas of diet drift. An updated diet history should be obtained at every visit and compared to the most recently prescribed HCD recipe to correct instances of diet drift.

Recipe modifications, including calorie adjustments and recipe reformulations, had been prescribed for many of the dogs in this study. The frequent need for modifications highlights the need for continued follow-up with a board-certified veterinary nutritionist after initial HCD recipe formulation. Owners should alert the veterinary nutritionist who designed the recipe about any changes in their dogs' medical conditions or changes in ingredient availability so that appropriate modifications can be made as needed. HCD recipes should be re-evaluated regularly so that veterinary nutritionists can assess dogs' health status, determine updated nutritional goals, and verify that diet plans are still appropriate or reformulate HCD recipes as needed.

Respondents in this study generally had positive experiences with feeding an HCD to their dogs and most respondents were still feeding an HCD at the time of the survey. Rationale for feeding an HCD varied, but many respondents preferred HCDs because of personal beliefs that are not currently supported by peer-reviewed evidence. In particular, many respondents perceived that HCDs are "healthier" or superior to commercial dog food, although evidence to support this notion is lacking. While increased control over diet was a common reason for feeding an HCD, the majority of respondents disliked the associated increase in time, effort and planning. Although some owners were motivated to feed an HCD due to a desire for greater palatability, palatability was reported by some respondents to be a benefit but by others to be a negative aspect of feeding an HCD.

There are a number of limitations to the current study. The sample population was limited to clients of a single veterinary teaching hospital's clinical nutrition service. Although multiple format options for survey completion were provided, a portion of the potential participant pool was lost to follow-up. As participation was voluntary, respondents may have had stronger positive or negative feelings about HCDs than non-respondents and thus be unrepresentative of the group as a whole. Reported feeding practices may have been inaccurate due to poor recall or social desirability bias (providing responses believed to be ideal). Several respondents did not complete all portions of the survey with as much detail as needed for complete adherence evaluation. Finally, due to survey design, the six owners of dogs that were still alive but were no longer being fed an HCD were not asked about their likes, dislikes and motivations for feeding an HCD.

Future research is needed to improve understanding of optimal HCD formulation and implementation. Further studies assessing the effects of diet drift on nutrient content of HCDs would help to measure the potential severity of nutrient imbalance resulting from owner non-adherence and identify nutrients

that are in high risk of imbalance. Prospective studies evaluating HCD recipe design and communication strategies would help to determine best practices to facilitate owner adherence.

The results of the current study provide insight that can help veterinary health care teams in the management of their patients and clients. For clients considering an HCD for their dog, diet formulation by a board-certified veterinary nutritionist must be recommended to avoid unbalanced recipes. Veterinary health care teams should review the benefits and drawbacks of feeding an HCD and discuss potential misinformation about commercial diets to help owners make informed choices. In addition, veterinary professionals should help clients set realistic expectations by discussing appropriate commercial diet options, possible benefits of greater customisation of HCD recipes and common challenges of feeding an HCD. Dogs fed an HCD should receive regular physical examinations and diagnostic monitoring as recommended by their veterinary health care team, have current feeding practices assessed at every visit, and have their HCD recipe re-evaluated regularly by a board-certified veterinary nutritionist.

Conflict of interest

Support for Dr. Johnson's residency was provided by P&G Pet Care. Dr. Freeman has received previous research funding from Nestle Purina PetCare and from P&G Pet Care. Dr. Heinze has received previous research funding from Hill's Pet Nutrition and

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